AGRICULTURAL NEWS LETTER

VOL. 22-NO. 1 JANUARY-FEBRUARY, 1954

This publication contains information regarding new developments of interest to agriculture based on laboratory and field investigations by the Du Pont Company. It also contains published reports of investigators at agricultural experiment stations and other institutions as related to the Company's products and other subjects of agricultural interest.

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AGRICULTURAL NEWS LETTER

Published bi-monthly by the
Extension Division, Public Relations Department
E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Wilmington 98, Delaware

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The AGRICULTURAL NEWS LETTER serves as a medium of reporting new developments and new ideas in the field of agriculture, particularly as they are related to advancements through research. Material appearing herein may be reprinted in whole or in part, in the interest of advancing the general knowledge of new agricultural practices.

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WHAT FARM EDITORS ARE SAYING --

"The greatest mistake our economists ever made was to teach us the word 'depression'. Maybe if we still called it by its right name, 'panic', our native American dislike of cowardice would keep us from succumbing to our own fears." -- Gordon Monfort in FARM MANAGEMENT

"Certainly there are two areas where research is needed: (1) the search for new knowledge and better products and (2) research on means of selling the materials produced. As in any industry there is a need to develop the potential market in the areas where the products are needed and to market in the most economical fashion. -- Walter Murphy in AGRICULTURAL AND FOOD CHEMISTRY

"Every father and mother who worries about 'teen agers should stop for a minute to remember past history. What were the old folks doing when they were 16?" -- WALLACES' FARMER & IOWA HOMESTEAD

"There isn't one of the chemical and equipment houses that won't sincerely try to solve the problem you put to them if it is in their line of experience. Good business is built that way. Service is the big difference when everything else is equal." -- Jim Nelson in PEST CONTROL

"Americans have been slow to recognize that a rich soil builds a rich civilization; that an impoverished soil means an impoverished people; that a nation cannot rise above its soil resources." -- Paul Sanders in THE SOUTHERN PLANTER

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THE STORY OF FARM CHEMICALS

Accompanying this issue of "Agricultural News Letter" is a new Du Pont booklet which we feel you will find both interesting and thought-provoking. Going far beyond the farm chemical history implied in its title, this publication tells the engrossing story of a revolutionary period in American agriculture, spurred by a flood of technological advances which have affected every phase of farm work and farm living. It also suggests an answer to that vital question -- "Where do we go from here?"

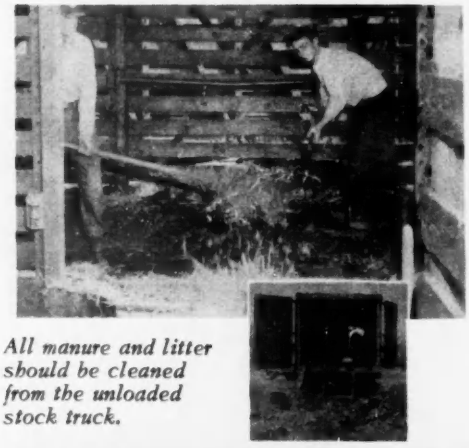
FIGHTING LIVESTOCK DISEASES

Every year sees some improvement being made in highways and country roads -- and every year livestock is hauled in greater numbers, faster and farther than ever before -- an involuntary migration of flocks and herds beyond the wildest dreams of the old trail drivers of the days gone by.

But along with these traveling farm animals has gone a parade of livestock diseases. Vesicular exanthema (V-E), hog cholera, shipping fever, swine erysipelas, anthrax, brucellosis (Bang's disease), tuberculosis, blackleg, and many another devastating enemy of the stockman have traveled about as fast from one section of the country to another as trucks could carry them, spreading diseases into formerly clean herds.

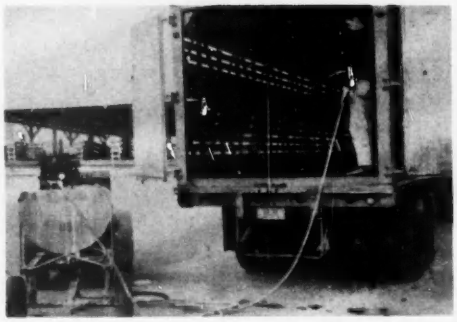
One of the most important steps which livestock haulers can take to prevent this spread of diseases is the fundamental business of thoroughly cleaning, washing, and disinfecting their trucks after each load is delivered. Since many stockmen maintain their own trucks and do their own shipping, a recent educational piece on this subject by Livestock Conservation, Inc., of Chicago, may be interesting to them. It outlines the specific disinfectant materials most effective in destroying disease organisms.

Four disinfectants are recommended by this organization for application by pressure sprayers to the truck interior, depending on the diseases against which protection is required. For protection against V-E, foot-and-mouth disease, brucellosis, hog cholera, shipping fever, swine erysipelas, and tuberculosis, three materials are available. Sal soda in an approximately 10 per cent solution, made with 13-1/2 ounces to a gallon of water; soda ash (sodium carbonate) in a four per cent solution (a pound to three gallons of water); or lye (sodium hydroxide) in a two per cent solution (13-1/2 ounces to five gallons of water), are all effective against these diseases. If protection against V-E and foot-and-mouth disease



All manure and litter should be cleaned from the unloaded stock truck.

Use a strong stream of water to wash remaining scum and dirt from truck.



With pressure sprayer, thoroughly apply the proper disinfectant material.

Above photos courtesy of Livestock Conservation, Inc., 405 Exchange Bldg., Union Stock Yards, Chicago 9, Ill. Write them for any further information on disinfecting livestock carriers.

are not required, but only against the other diseases mentioned above, "cresylic disinfectant"* in a four per cent solution can be used, made with a cup of the disinfectant to two gallons of water.

If, in addition to these diseases, those tough customers, anthrax and blackleg, are also to be controlled, a more severe treatment is called for. The Livestock Conservation, Inc. recommendation here is for a five per cent lye solution, using around 4-1/4 pounds (five 13-1/2-oz. cans) to 10 gallons of water. This lye solution should be allowed to remain in the vehicle for eight hours, then should be washed away with water before loading the truck with more stock.

Whenever lye is used at any strength, protective goggles, rubber gloves, and coveralls should be worn. If any of the solution comes in contact with any part of the body, vinegar should be applied to neutralize the lye and prevent severe burning.

* USDA approved, marked on can.

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MAN-MADE SPONGES ARE LATEST THING FOR "BOSSY'S" BOUDOIR

New use for the cellulose sponge -- that udder washing job in the dairy barn!

Tailored especially for dairy use, sponges cut eight inches square and three-eighths inch thick are being offered by a Wisconsin company. The sponges will rinse out cleanly and resist odor development, and tests have shown each sponge should hold up for at least 800 washings. On the many farms where rapid milking practices are followed, and where the application of warm cloths to the udder just before putting on the machine also serves to stimulate the let-down of milk, cellulose sponges have the added advantage of good heat-retention.

One tip on the care of these sponges -- if they are used with water containing normal solutions of hypochlorite, or other chlorine disinfectants, sponges should be rinsed out in clear water after each use. They can be sterilized by boiling, if desired.

Using the cellulose sponge in a large commercial dairying operation. Each sponge will wash at least 800 udders, tests indicate.

NEW HORIZONS IN WEED CONTROL

"In 1945, hardly any investigator would have believed it possible to develop a chemical with greater herbicidal potency than 2,4-D. Yet in less than five years we have but to witness the herbicidal activity of the substituted ureas. This development indicates that we have accomplished an objective which many thought impossible." -- excerpt from "Recent Advances in Weed Control," paper by W. C. Shaw and R. L. Lovvorn, USDA agronomists, delivered at 1953 Spring meeting of the National Agricultural Chemicals Association.

Substituted urea compounds, a family of weed killers which promises to revolutionize the control of unwanted growth on cropland, industrial sites, and public property, came of age in late 1953 with the issuance of patents for these developments of the Du Pont Company's agricultural research program.

First representative of this herbicidal family tree was CMU, which became available as an industrial weed killer, for soil sterilization purposes, about one and one-half years ago. During the past year, the first three crop uses for CMU have reached the "recommendation stage" -- in pineapple fields in the Hawaiian Islands, on sugar cane plantations, and most recently in asparagus beds.

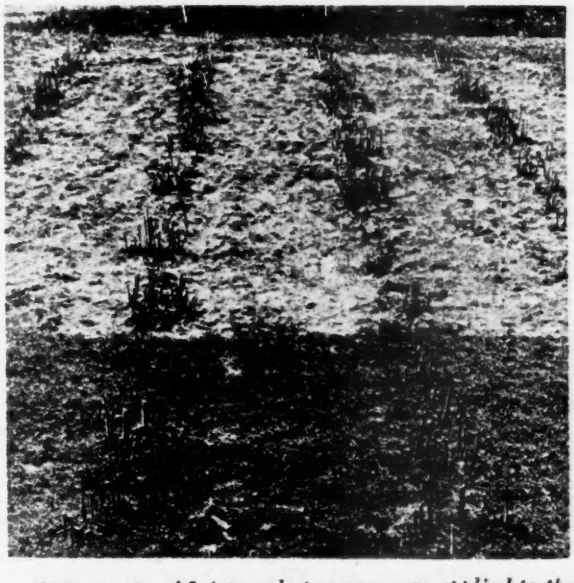
Another representative of the family, phenyldimethylurea, is still in the experimental stage, with some of the nation's most stubborn weeds its prime targets. Tests indicate it holds rare promise to kill patches of perennial weeds such as field bindweed and Canada thistle in cropland. (See Agricultural News Letter, Vol. 21, No. 6, p. 103).

Still another of these compounds is being given extensive evaluation for selective weed control in cotton. Applied as a pre-emergence treatment, it appears to provide control of weeds and grasses during the critical early life of the cotton seedlings, cutting out hand hoeing operations and resulting in healthier crops that produce more lint per acre.

An example of the effectiveness combined with versatility which these substituted urea compounds offer is to be seen in the case of CMU.

Where all vegetation must be killed and the ground kept free of growth over an extended period, to remove fire hazards, rat harborages, or heavy growth which interferes with industrial or maintenance operations, 20 to 40 pounds of CMU will usually keep an acre free of vegetation for a season or longer. Other chemicals used for the same purpose must be applied at rates of from 800 pounds

An asparagus bed where CMU was tested to control weeds. Note healthy asparagus growth in treated plot (right) one month following treatment.



CMU at rate of 2.4 pounds per acre was applied to the asparagus plot in background. Note weed growth in untreated plot in foreground. Photo taken four weeks after treatment. Both above photos courtesy of Michigan State College.

to several tons per acre to equal this effect. In fact, CMU is the first organic chemical which can be used as a soil sterilant.

In contrast, consider the latest crop use for which CMU has been recommended -- in asparagus beds. Here only from two to four pounds of CMU is applied per acre, either one to four weeks before cutting, immediately after the cutting season, or at both stages. Field tests have been conducted in Michigan, Massachusetts, Rhode Island, Washington, California, New Jersey, Illinois, Delaware, and Pennsylvania, and as little as two pounds of CMU per acre, applied only once in the growing season, has kept asparagus beds free of annual weeds and grasses for eight weeks or more.

Unlike 2,4-D and other organic chemicals used for weed control, CMU does not kill plants by absorption through the foliage and translocation to other sections of the organism. Its entrance is made through the roots, from which it is carried upward in the plant. First sign of activity is a browning and die-back of leaf tips, followed by progressive discoloration of foliage and eventual death of the plant. Its action is dependent then on rainfall or other ground moisture, to carry the chemical into the soil. For this reason, effectiveness of the chemical may vary depending on rainfall, type of soil, or depth at which root systems of weeds and grasses are located. While CMU is generally conceded to be nonselective, certain plants such as pineapple, sugar cane, and asparagus show sufficient tolerance for the chemical to allow its use within recommended limitations to kill weeds without injuring the crop.

CMU is formulated as a wettable powder which is readily suspended in water. Constant agitation

of the spray is required when it is being applied. If a power equipment is used, a tank with agitator should be employed. CMU is non-corrosive and non-flammable. While it is virtually non-toxic to warm blooded animals, careful analytical tests have been made to assure the safety of customers of all crops where it was employed to control weeds. In the asparagus case, for instance, tests were conducted on asparagus prepared for the fresh produce market, after commercial freezing and packing, and after canning. Analytical methods developed to detect CMU when only one part per billion is present help in the development of recommendations for the safe use of these potent new herbicides.

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RESCUEGRASS SEED TREATMENT

One of the principal problems in introducing Rescuegrass in the South has been its susceptibility to the smut organism, according to a report from Clemson Agricultural College in South Carolina. Recent tests by a commercial laboratory, however, have indicated that the mercurial "Ceresan" M seed disinfectant can be used to effectively control smut in this grass.

In the tests, application of four ounces of "Ceresan" M per 100 pounds of seed seemed to promote maximum seed emergence. Because of the hully nature of the seed, it is important that treated seed be stored at least two days before planting in order to get proper disinfection. While thiram is preferred over the mercurials for the treatment of most grasses and small-seeded legumes, "Ceresan" M was used on the Rescuegrass because of its known effectiveness for the control of smut on brome grasses, sorghums, and small grains.

NEW NAME FOR NYLON SPINNING LINE

Fishing enthusiasts who have taken up the new spinning technique will be interested in knowing that a new trade-mark, "Tynex" has been adopted by the Du Pont Company to apply to its nylon monofilament line. The new name does not apply to braided fishing lines made from nylon textile fibers produced by the company. "Tynex" lines for spinning have made a particular contribution to this new fishing art because they provide a limp line that is less springy and does not balloon off in coils from the spool of the reel. In addition, "Tynex" line is practically invisible in the water, needs no soaking, and will not kink, ravel, become brittle, or snarl. The new name will aid fishermen in distinguishing between the Du Pont product and competitive materials to which the generic name, nylon, may be applied.

LIFE OF GALVANIZED SURFACES

ON FARM EXTENDED BY PRIMER

One of the most highly specialized paints, and an extraordinarily efficient performer in the role for which chemists designed it, is Du Pont zinc dust galvanized metal primer. Because there is such a substantial investment in galvanized metal materials on modern-day farms constantly under attack by the forces of rust, this unusual protective coating deserves to be better known, and used.

No other type of paint will endure over galvanizing for a satisfactory period. High grade finishes that last for years on wood or steel soon flake off galvanized roofing, siding, gutters, downspouts, water tanks, fencing, screens, refuse containers, et cetera.

Chemists solved the peeling problem in a novel yet entirely logical way. They found that zinc would adhere firmly and lastingly to zinc. Moreover, in additon to mechanical protection, zinc dust primer behaves in a manner unique for a paint. It is, as the chemists describe it, "self sacrificing". Roughly, this means that rust is prevented or inhibited because the rust-forming acids actually feed on the zinc in the primer rather than upon the galvanized metal surface.

Another unusual feature of Du Pont galvanized metal primer is that it is packaged in a two-compartment container. For, once the dust in the small portion of the can is mixed with the synthetic resin vehicle, hydrogen gas is generated which will pop the lid if the mixture is confined in the container. Accordingly, the manufacturer recommends mixing only the amount that can be consumed on the job at one time. (Ready-mixed zinc dust primers are obtainable but laboratory tests show them to be less durable than the mix-it-yourself variety.)

Since zinc dust primer is medium gray, it is frequently top-coated with house paint to match the body color of the house or farm building, especially to render gutters and downspouting inconspicuous. The primer itself is so durable, however, no topcoating is required to achieve prolonged freedom from rusting.

The primer is specified both for new and weathered galvanized surfaces. New surfaces should be cleaned with turpentine or mineral spirits to remove all factory-deposited grease and oil. Authorities warn against the old practice of washing new galvanized surfaces with vinegar. All this accomplishes is to etch away some of the protective galvanized coating. Old surfaces require only a soap and water wash. Rusted areas should be sanded or wire brushed.

Where staining of sills and siding from copper screening is a problem, this too can be prevented by an application of the primer on the mesh.

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ANTI-SLIP BOOT SOLES REDUCE HAZARD OF WET BARN FLOORS AND ICY FOOTING

If slipping on a wet barn floor or an icy flight of back steps is one of the hazards that has plagued your winters, there's good news in an anti-slip design for soles of boots and overshoes, now being made available on several lines of rubber-soled footwear.

The development is a patented tread made up of a series of concentric circles which grip with a squeegee action and provide excellent traction on wet, icy, or oily surfaces. They were originally designed for the Navy to provide sure footing on the slippery decks of aircraft carriers. More than a million pairs of flight deck boots and overshoes equipped with this sole have been issued to Navy men.

One dairy processing plant which has tested the new sole design on overshoes made of neoprene synthetic rubber reports that in service around the plant, and in cleaning the interiors of milk holding tanks, it "provided the most satisfactory footing of anything used in the rubber class."

The new sole is being made available on both knee and hip boots, galoshes, and conventional rubbers. In addition to the non-skid advantages of the tread design, the use of neoprene in these products provides a material which resists barnyard acids, and the degradation which butterfat, gasoline, and oil produces in natural rubber.

As with all irregular sole patterns, the new design tends to pick up mud when used out-of-doors in wet weather. Under such conditions, wearers are no more welcome clomping across the floor of a freshly scrubbed kitchen than they would be in any other boot.

In addition to boots and overshoes, the new sole design, called "Tri-Vac", is appearing on work shoes, on gym shoes, on heavy-duty oxfords, and on a line of fleece-lined boots and shoes for cold weather work, hunting, and other winter sports.

Here's a representative group of rubber footwear equipped with the anti-slip "Tri-Vac" sole. Designer of this sole for use of Navy personnel on aircraft carriers was Al Fellman, lifelong shoe merchant. Use of neoprene adds longer life to boots through resistance to chemical deterioration by barnyard acids, butterfat, gasoline, or oil.

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UREA IN WINTER RATIONS FOR EWES*

To keep ewes in good condition for spring lambing, protein supplements are usually required during the winter. While experimental work at a number of stations has shown that urea can be used to complement protein feedstuffs in a fattening ration for ruminants, less information has been available regarding the relative value of urea in rations fed to pregnant animals. Since the supplements are generally the most expensive part of the winter rations for ewes, an investigation has been carried on in South Dakota to find less expensive sources of protein.

The value of urea as a part of the protein supplement of pregnant ewes was investigated during the winters of 1949, 1950, and 1951. Among the factors studied were: (1) ewe gains, (2) fleece weight, (3) lambing percentage, (4) birth weight, (5) weaning percentage, and (6) gain of lambs.

A comparison was made between soybean oil meal alone, and equal parts of soybean oil meal and alfalfa in combination with five and 10 per cent amounts of urea.** The results of these feeding tests over the entire three-year period are summarized in the accompanying table. Within the period covered, additional supplements were fed in which wheat mids were substituted for alfalfa and in which the ratio of alfalfa to soybean oil meal was varied from equal parts to three-to-one. No significant differences resulted in these variations.

An analysis of the results obtained in the individual years showed some variation among lots in the factors studied, but the differences were not great and were not consistent from year to year. The gain in weight of the ewes, fleece weights, lamb-birth weights, and average weight of lambs on pasture at approximately 55 days of age show little difference among lots. The slightly heavier lamb weights at 55 days of age in Lots I and III are due to rather large differences in weight during one particular year which were not evident in other years.

The number of lambs, born and weaned, and the number of

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* This information is condensed from data by R. M. Jordan, presented in South Dakota Agricultural Experiment Station Bulletin 429. The work was carried out under carefully controlled conditions.

** During the three winters while this experiment was in progress, soybean oil meal varied in price in South Dakota from $100 to $120 per ton. During the same period, dehydrated alfalfa varied from $60 to $70 per ton. Thus, the supplement containing urea constituted a saving of the order of $20 per ton. It is not recommended that urea in the form of "Two-Sixty-Two" feed compound be used in feed supplements in amounts in excess of five per cent. This recommendation is made so that most effective results may be achieved.

dry ewes show some variation among lots. The high lambing percentage for Lot I is largely due to the comparatively large number

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Effect of 5 or 10 Per Cent Urea Supplements on Pregnant Ewes

Summary 1949, '50, and '51

Fed 102 Days	Soybean Meal I*	Soybean Alfalfa Equal Parts Plus 5% Urea II	Soybean Alfalfa Equal Parts Plus 10% Urea III
Number of ewes	37	37	37
Average weight per ewe (lbs.)			
Initial weight	144.0	143.0	143.0
Final weight	151.0	150.0	149.0
Gain per ewe (lbs.)	7.0	7.0	6.0
Fleece weight (lbs.)	7.7	8.2	8.0
Number lambs born	41	37	39
Number dry ewes	6	8	4
Average birth weight (lbs.)	9.5	9.0	9.4
Number lambs weaned	31	29	34
Average pasture weight first 55 days (lbs.)	35.7	31.2	34.1
Average daily ration (lbs.)			
Brome hay	3.2	3.2	3.2
Protein supplement	0.19	0.2	0.15
Corn**	0.5	0.5	0.5
Total feed per ewe (lbs.)			
Brome hay	323	323	323
Protein supplement	19.7	20.4	15.3
Corn**	11.3	11.3	11.3
Per cent of hay weigh back	7.5	8.3	8.8

*Five per cent molasses was added to each supplement to facilitate the manufacture of the pellets as well as add palatability to the pellets.

**Corn fed at the rate of 0.5 lb. per ewe daily during last 2 to 4 weeks of gestation.

of lambs born and weaned in 1949 and 1950. Management is likely to have played a greater part in the number of lambs born and weaned than did the ration fed the ewes during their gestation period.

The following conclusions were drawn from the experiment:

1. Protein supplements containing as much as 10 per cent urea caused no undesirable effects on the ewes and did not prove unpalatable.

2. Total gain made by the ewes, fleece weights, lambing percentage, weaning percentage, birth weight of the lambs at 55 days of age apparently were not affected by the type of protein supplement fed (soybean meal or protein supplement plus urea) or level of urea in the supplement.

3. Provided sufficient quantities of carbohydrates are fed, either five or 10 per cent urea may be added to a protein supplement without adversely affecting productivity.

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MUSCA DOMESTICA NOW WEARS NYLON

A novel use for nylon thread is reported by U. S. Public Health Service entomologists. They're using it in studying the life of the house fly.

A mechanical fly-tagging device has been developed which ties inch-long nylon threads around the bodies of the insects. The equipment will hold 25 flies at a time, after they have been anaesthetized with carbon dioxide. The flies are moved under the point of a small hypodermic syringe, from which glue is applied to fasten the nylon threads. About 1,600 insects a day can be banded.

Threads of different colors are applied so entomologists can locate, recover, and identify the flies after their release. The strong, but lightweight nylon threads, when properly attached, do not interfere with the normal flight and other activities of the flies.

Data being compiled through tracking down these nylon-bedecked house flies is expected to shed new light on their normal flight range, rate of dispersion, and reaction to various types of insecticides.

SOME CHEMICAL INDUSTRY RESPONSIBILITIES

IN MEETING THE GOALS OF AMERICAN AGRICULTURE

by Dr. Max T. Goebel
Director, Technical Division
Grasselli Chemicals Department
E. I. du Pont de Nemours & Company

In my title -- "Some Chemical Industry Responsibilities in Meeting the Goals of American Agriculture" -- I should like to emphasize the qualifying word "some". Certainly I should not attempt to speak for the whole chemical industry on this very broad subject. Furthermore, what I say will be limited by my own personal background and by our collective experience in the research laboratories of only one member of the chemical industry, the Du Pont Company. Nevertheless, it seemed to us that there are some points of view which may be of interest, since we believe that they are quite typical of thinking going into the planning of agricultural chemicals research throughout the industry.

The first responsibility I should like to discuss may seem self evident. However, to fulfill this responsibility requires hard thinking of all concerned with industrial research aimed toward products to be used in agriculture. This responsibility is the very basic one of being sure our research programs are directed along lines that will result in products agriculture really needs.

Timing is extremely important. Let us illustrate by an analogy with another phase of industrial research. It is common practice in the chemical industry not to stop work on a process when a plant is built. Rather, from the day a new process goes into operation, trained research men, and particularly chemical engineers, carefully examine the operation to see how it can be improved. Perhaps equipment modifications will be required. Perhaps the operating procedure can be changed to advantage. All this effort is basically directed toward improving the economics of the process and the quality of the product.

Two Roads to Improvement

Now, there are two general ways in which an economic improvement can be obtained. One is to cut the operating cost while maintaining the same rate of production. Another is to increase the rate of production by removing bottlenecks. Of course, an increase in rate of production usually brings a saving in unit operating cost. The direction of the effort, whether primarily toward lower unit cost or toward greater rate of production, is determined by one all-important factor, the market need, which may be projected a good many years. If chemical engineers were to wait until the increased demand really materialized, it might be too late to increase production by the most economical means.

In the same way, those responsible for planning research

directed toward new products for agriculture must take into account the market forecast for agriculture itself. Without using charts or graphs, we can visualize pretty clearly what the market for agriculture looks like today. Barring catastrophic events such as a general and long continued drought, it appears that for the next few years agriculture can readily supply the food requirements of the American people.

The problem of agricultural surpluses is likely to be with us from time to time over the near-term future. If we had this situation in one of our plants, we would say that there was ample capacity to meet the demand for the next few years. Consequently, we would put our effort primarily on cutting the unit cost of the product. Work would also be carried on to assure maximum safety in the operation and to guard against possible shutdowns and loss of production.

Cut Farmer's Cost of Production

Applying this analogy to agriculture, it seems logical to look upon the greatest immediate need of the American farmer as being for chemicals to cut his cost of production and help improve his financial return on his investment in land, equipment, and labor. Also, we should feel there is a continuing need for chemicals which will protect the return on his investment against losses, which we might compare with an accident or enforced shutdown in a plant.

Now let us see what this means in terms of products. One of the earliest contributions of the chemical industry to agriculture was in the form of products to protect the farmer's return on his investment. We can think here of fungicides which the farmer uses to guard against complete or partial loss of his crops. To a very large extent, insecticides perform the same function. In both cases, there is available to the farmer insurance which he can secure at very short notice when catastrophe threatens. In some cases, of course, he knows by experience that he must have the insurance if he is to raise a crop at all.

From the national standpoint, we recognize that the use of insecticides, fungicides, and similar products has contributed greatly toward increasing the overall yield of American agriculture, and thus, one might argue, has assisted in bringing about the very surpluses which plague agriculture as a whole from time to time. However, from the standpoint of the individual farmer, they function as a safeguard to protect his livelihood.

Chemicals and Surpluses

Also, one can argue that these insurance chemicals should, on the average, reduce the problem of surpluses rather than accentuate it. Let us suppose there were no insecticides available to control the more important insects which attack cotton. To assure enough cotton to meet the country's needs, a tremendous acreage would have to be planted so plenty would be left over to satisfy the hungry boll weevil and bollworm, as well as their relatives,

the aphid, the army worm, and so on. Then supposing that we had a year like 1952, in which there were relatively few bugs. The surpluses we experience from time to time might be as nothing compared to the flood of cotton which would suddenly descend on the country's economy. Thus, these insurance chemicals play a part, overall, in cushioning the "boom and bust" cycle we all would be very glad to see eliminated from the agricultural economy.

Consequently, the research man feels that over the next five or ten years it is one of his responsibilities to remain very active in the never ending battle of man against plagues such as insect and fungus diseases. Certainly the fact that agriculture can now supply the food requirements of our people should not cause us to let down for one moment in the effort to provide the farmer with the best chemical insurance research ingenuity can provide.

Another type of contribution the chemical industry has been striving to make is to furnish the farmer with products to lower his cost of production on a unit basis. Perhaps the most spectacular type of product in this category is the selective weed killer. The interesting statement has been made that one man manufacturing such a weed killer is equivalent to 800 people wielding hoes.

More Dollars -- More Leisure

This comparison sets forth very clearly a type of contribution which is of great interest to the farmer. Whether he thinks of it in terms of dollars saved, or in terms of greater leisure which he may employ in other directions, here he can see a very direct benefit through the use of chemicals, regardless of the state of the market for his product.

We could go on to multiply examples of money saving chemicals -- for example, chemical defoliants for certain crops, or the various feed supplements which help decrease the per pound cost of raising poultry and certain types of livestock. In view of the farmer's individual need for the lowest possible cost of production, it certainly would appear a real responsibility of research men in the chemical industry to concentrate a lot of research thinking in these next few years on new developments to save the farmer money.

In general, we should recognize that the end is not yet in sight as regards the need for types of products which the chemical industry has been developing over the last 20 years. The constant appearance of new pests, and the development of resistant strains, merely serve to emphasize this conclusion. Despite the vicissitudes of the agricultural chemicals business, which have received considerable publicity in the last six months or so, not only research men but managements and sales divisions of the various chemical firms engaged in the agricultural chemicals business share this point of view.

Long Range View

Let us turn now to the very long range market forecast. Here the picture looks much different. You are all familiar with

the recent trends in population growth which have carried us to a population of 160 million, as estimated by the Census Bureau. You are familiar with the projections which indicate that, for every four plates at the national dinner table today, the farmer may have to fill a "fifth plate" by 1975. Government officials are already well aware of this possibility and are gearing their research programs to meet it.

In the same way, industry, in considering its research programs, must take into account a possible need for considerably increased food supplies within 25 years. Of course, one can never be certain that the possibility will materialize. Certainly, population trends depend in the last analysis on human nature. Such factors as confidence in the future, and the prospect of economic security, have a great deal to do with the growth of populations. Yet, I do not believe one can argue with the conclusion that, from the standpoint of the entire nation, research is the cheapest and most flexible safeguard against shortages in the future.

Now, 1975 seems a long ways off to us in 1953. However, there is one thing the industrial research man learns -- sometimes by bitter experience. It takes a long, long time, after an exploratory or fundamental program is started, before leads are developed, explored, and converted into new products. Our company made a survey of a number of its developments some time ago and came up with an estimate that nine to 19 years have elapsed between initiation of exploratory work in a new field and the eventual development of a new major commercial product growing out of that research. As a well known example, we might cite the fact that 11 years elapsed between the beginning of Carothers' fundamental research on linear polymers and the opening of the first nylon plant.

Don't Count on Miracles

There are exceptions, and sometimes, under the stress of necessity, the seemingly impossible can be accomplished in telescoping the time schedule. The effort on atomic energy during the war and the synthetic rubber program during the same period are outstanding examples. However, from the standpoint of prudence, we should not count on such near miracles.

Industry in general, and certainly we at Du Pont, are thinking very seriously about the need for long range research directed toward ways of radically increasing crop production from our existing acreage. As you are aware, there is great interest in entirely new departures in growing food, such as the hydroponic culture of certain forms of algae. The prudent research planner will also consider more conventional means of reaching the food goals of 25 years from now.

The supply of plant nutrients, including the major and the trace elements needed for plant growth, will continue to be of critical importance. New application techniques for more efficient utilization of these elements will be important. Improved animal nutrition must play a part in increasing the future food supply. New

sources of feed may have to be tapped. As an example of what can be done, one might cite the development of synthetic urea as a building-block for proteins in feeding ruminant livestock such as cattle and sheep. This has been a development in which research by land-grant colleges has played a particularly outstanding role.

Looking in the Crystal Ball

Other less obvious needs must also be anticipated by research men. When they look into the crystal ball and think about chemicals which might remove tremendous bottlenecks from the agricultural plant of this country, research people see so many fascinating possibilities that the difficulty is to choose those which hold the greatest hope of practical success and real solution of the problem.

The chemist may also play a less spectacular, though still important, role. To cite one example from our own experience in Du Pont, we have been told that the introduction of hybrid corn could not have been accomplished nearly as rapidly if Du Pont's "Arasan" seed disinfectant had not been available at the right time. The plant breeder's creations of the future may also require new auxiliary chemicals to make them successful.

The long range forecast indicates that the chemical industry should be bold in its attack on new lines of long range research which hold hope of some day greatly increasing agricultural production from our existing acreage. It looks as though there will be a real need for such research developments by the time they are likely to become available in adequate measure.

I should like to turn now to another responsibility of the chemical industry, as we at Du Pont see it. We are convinced that our chemical research should be coupled with thorough and conscientious biological evaluation of the leads we turn up. This is a heavy responsibility because such evaluation, which we call "use research", is expensive. Although I canot quote figures to prove the point, I am sure most research planners would agree that use research is a field in which one cannot "send a boy to do a man's work".

Job for Biologists

Large groups of biologists are necessary. They must be well trained and allowed to work in a specific field long enough to become expert in it to detect stumbling blocks which might otherwise wreck a promising development. However, we feel this is the only right way to do our job for agriculture. If we were to flood federal, state, and university investigators with essentially untried leads, we would simply confuse the whole agricultural research picture.

Consequently, one of the most important phases of agricultural research planning in the chemical industry is the proper selection and building of strong biological research staffs to work

with chemists who turn out candidate chemicals. This does not by any means imply an underestimation of the importance of investigators in state experiment stations or in land-grant college laboratories, nor of research people in federal bureaus.

I am sure all of you are well aware of the magnitude of the job of really putting to work in agriculture an important new chemical, regardless of where the initial work is done. First of all, there is the problem of geographical variation due to differences in climate, soil, and the specific types of crops being cultivated. Weeds, insects, and plant diseases vary in a most amazing manner from one section to another. Various application techniques and farming practices must all be taken into account.

Finally, there is the tremendous and very important task of offering advice and counsel to the individual farmer. All these problems are being worked on very ably by public-spirited research men in colleges, as well as in state and federal organizations. We should not multiply their burden by asking them to evaluate new products and techniques until we have convinced ourselves they are really sound.

Du Pont Procedure

Our typical procedure in Du Pont runs something like this. When a new agricultural chemical candidate is uncovered, we subject it first to a thorough evaluation in the laboratory or greenhouse. The following spring, we take it to the field, if it has continued to look good. We maintain a force of field men in the west, in the east, in the south, and in the midlands. Outstanding results and great promise are necessary if we are to be content with one year's testing under our own steam. More often, good results over a two-year period are required before we ourselves are convinced we have something worthy of investigator attention.

At that time, we notify all investigators in the general field where we believe the chemical will have value, summarize our data for them, and make samples available to those who wish to test it. Even then, we may find we are wrong. When the results come in from the first year in the hands of agricultural research people, we may find our earlier field sample had not been sufficient and that broader evaluation has uncovered important weaknesses, such as failure to work under certain important climatic conditions. Phytotoxicity may be encountered despite meticulous attention to this important aspect in the early investigations.

At that point it is certainly our responsibility to inform all of the investigators very frankly regarding our disappointment. If the disappointment is seriousenough so we can decide at the end of one season that we probably will not proceed to commercialization, it is our responsibility to inform investigators just as soon as that decision is reached. Only in this way can we contribute toward

economics in the very costly business of agricultural research.

The Safety Factor

A third major responsibility is to assure ourselves that a new product can be used safely. There are, as you know, many aspects to this problem. The use of proper label precautions is only one step in a very important and often very complex research operation. We must consider the hazard to the user, the hazard to his equipment, the hazard to the neighbor's crops. Finally, and most important of all, we must consider with great care any possible hazard to the consumer of the farmer's product. We must not feel we can leave this responsibility entirely to a government agency. We must, if we possibly can, anticipate every question that may be asked and have the answer, or be able to give assurance that the answer will be forth-coming at the proper time.

I believe I echo the sentiments of the whole agricultural chemical industry when I say it has everything to gain and nothing to lose from a very vigorous and vigilant national program on the part of the Department of Agriculture and the Food and Drug Administration. In our contacts with the responsible officials of these agencies, we have found them at all times eminently reasonable and entirely fair. We have no fears for the future in this respect.

What are the most important things the research planner must do to cooperate properly with these government agencies? First of all, he must know the properties of his product thoroughly. He must measure its physical properties with care and consider their significance from every standpoint. Second, he must see to it that workable analytical methods, within the reach of any well equipped laboratory, are made available by which even minute traces can be detected. Almost always, this job can be done if we roll up our sleeves and go to work. In one recent case, we were able to develop methods which were significant down to one part in 100 million, and in one special application of major importance we were able to carry the detection level down to one part in one billion. Believe me, when you have such methods, you can sleep better at night.

Toxicity Studies

Next, we must see to it that thorough studies of acute and chronic toxicity are carried out. We need not dwell on this point because the importance of such tests is universally recognized. Rather, I would like to leave the thought that the micro-analytical method, which may serve as a guide toward techniques for completely eliminating any hazard by complete or substantially complete elimination of residues, is an equally powerful weapon in the fight to eliminate hazard.

We should think through very carefully the various ways in which a new agricultural chemical may be used, and carry on our analytical programs in such a way that we trace the farmer's product through its processing steps. And we should not neglect the by-products. For example, in evaluating chemicals to be used on cotton,

we should not only examine their possible effects on the quality of the cotton itself, but also on the palatability and safety of the by-product cottonseed oil and meal. Effect on succeeding crops should be determined as well.

This may seem elementary, but it is always amazing to see how easy it is, under the constant pressure of the day by day research job, to develop blind spots. This is an area where regulatory agencies, with their long and varied experience in assessing the safety of many candidate products, can be particularly helpful through their suggestions. Believe me, we appreciate their help.

The Information Job

Another responsibility is the gathering and correlating of use data from all parts of the country, once a new chemical has been subjected to field demonstrations and grower tests. This information is then boiled down to be readily available to investigators, members of extension services, and others who contact farmers. It is also our responsibility to see that distributors of our products are supplied with practical and scientifically correct schedules to augment the information customers receive via their county agents. Factual selling must be stressed and extravagant claims avoided at all times. All this is just good selling, but it requires much effort on the part of technically trained people in our sales divisions.

I should like to mention one more responsibility, namely, that of helping to encourage boys toward a farm career. We in Du Pont are extremely interested in organizations such as the Future Farmers of America, the Future Home Makers of America, and the 4-H clubs. One of our jobs is to help these boys and girls to an even greater appreciation of the part chemistry can play in making life on the farm more profitable and pleasant. I am sure the entire chemical industry concerned with products for agriculture is always glad, by means of published literature, visits to laboratories, and in other ways, to help leaders of these wonderful movements acquaint their boys and girls with what chemical research can do for them, and what it may be able to do in the future.

It is of course important to us that land-grant colleges continue to turn out well trained chemists, biologists, and biochemists. As you know, Du Pont, like many other firms, is trying to help by fellowships and grants for fundamental research in various fields and to assist colleges in continuing their splendid job of training research men. However, we think it is equally important that we keep in mind the future user of our products and see to it that we help train him just as thoroughly as we are trying to train future research men.

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EDITOR'S NOTE: The preceding article is condensed from a speech by Dr. Goebel before the Division of Agriculture, Association of Land-Grant Colleges and Universities, during their recent annual convention in Columbus, Ohio.

EXPERIMENTERS' NOTATIONS

A Round-up of Data from Across the Nation

Sesame, one of the oldest oil crops cultivated by man, is being introduced in Texas and other southwestern states, and seems to be another crop which seed treatment aids in getting off to a good stand. In a test by a grower near Plano, Texas, half of a six-acre field of sesame was planted to seed treated with "Arasan" seed disinfectant, while the other half was untreated. Seeding was done with a two-row drill on May 8. On June 19, random counts taken in treated and untreated portions of the field showed 92 per cent more healthy plants in the rows sown to treated seed.

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Three foreign invaders, all cockroach species new to the United States, are being reported in various sections of the country. These are: (1) the Madiera roach, now established around fruit stores and markets on the east coast; (2) the Mediterranean roach, now to be found in the Cape Cod area, an out-of-doors pest that comes into houses at night; and (3) the East African roach, recently found in Florida. This latter one likes warmth and can live in heated buildings in the North. It is now established around granaries in the Hawaiian Islands.

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Seventeen pairs of Holstein cows in three New York herds were used in an experiment by Dr. L. H. Schultz of Cornell University to determine the possibility of feeding sodium propionate as a preventive drug to control ketosis (acetonemia). One cow out of each pair was fed a quarter-pound of sodium propionate daily for six weeks following calving. A "decreased incidence of ketosis" in favor of the propionate feeding was reported, but Dr. Schultz declares that "further data are needed before definite conclusions can be drawn."

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The question of how soon hay or pasture sprayed for insect control can safely be fed to cattle is important, particularly to dairymen concerned with the possibility of milk contamination. The USDA's recent leaflet on control of the meadow spittlebug outlines these precautions: "Apply lindane to clover or alfalfa at least two weeks before cutting or pasturing, and allow at least 40 days between application of toxaphene to these crops and cutting or pasturing them. If you use methoxychlor, you can cut or pasture the crops within a few days after treatment."

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